



# Microbiology Major Requirements

## Program in Biology Student Services

📍: 1140 Undergrad. Science Bldg. (USB)

🌐: <http://www.lsa.umich.edu/biology>

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### Why study Biology?

"Pursuing a career in biology can be immensely rewarding and exciting. Studying biology teaches us to ask questions, make observations, evaluate evidence, and solve problems. Biologists learn how living things work, how they interact with one another, and how they evolve. They may study cells under a microscope, insects in a rainforest, viruses that affect human beings, plants in a greenhouse, or lions in the African grasslands. Their work increases our understanding about the natural world in which we live and helps us address issues of personal well-being and worldwide concern, such as environmental depletion, threats to human health, and maintaining viable and abundant food supplies." [from: <http://www.aibs.org/careers>]

### Who should major in Microbiology?

Microbiology includes the study of viruses, algae, bacteria, protozoa, and fungi. Immunobiology is also included within the science of microbiology. A major in microbiology prepares students for graduate study in microbiology, biochemistry, agricultural science, and food science, as well as for study in other areas of biology which emphasize cellular structures and their function. A bachelor's degree in microbiology may qualify students for entry-level positions in medical, industrial, or governmental laboratories.

Students intending to go to medical school should compare degree requirements to the med school requirements found here: <http://www.lsa.umich.edu/advising/academicplanning/prehealth>. It is strongly recommended that pre-med and other pre-health students meet with an LSA pre-health advisor.

**Exclusions:** Students who elect a major in Microbiology may not elect the following majors: Biology; General Biology; Cellular and Molecular Biology; CMB:BME; Ecology and Evolutionary Biology; Ecology, Evolution, and Biodiversity; Plant Biology; Neuroscience; Biochemistry; or Biomolecular Science. They also may not elect an academic minor in Biology; Ecology and Evolutionary Biology; Plant Biology; Chemistry; or Biochemistry.

### How do I declare?

Students interested in any major in the biological sciences are encouraged to meet with an advisor to discuss their academic plans as soon as possible! Students need not have completed all of the major prerequisites to declare, but should have completed the biology introductory sequence with a 2.0 or better and be in good academic standing. Make an advising appointment online through the Biology website: [www.lsa.umich.edu/biology](http://www.lsa.umich.edu/biology).

### What courses should I take first?

The biological science introductory sequence consists of: BIOLOGY 171, BIOLOGY 172 or 174, and BIOLOGY 173. (Students with an appropriate AP score receive credit for BIOLOGY 195, which is the equivalent of BIO 171 & 172/174, but does NOT grant credit for 173.) Students should take 171 or 172/174 first and then follow with the second lecture course and 173. *(Note that the introductory biology sequence courses cannot be taken pass/fail.)*

<u><b>BIOLOGY 171</b></u> ...focuses on ecology, biodiversity, and genetics and evolutionary processes. Students engage with biological hypotheses dealing with prominent current issues such as human evolutionary origins, emerging diseases, conservation biology, and global change.	<u><b>BIOLOGY 172 or 174</b></u> <b>(prerequisite: prior or concurrent credit for CHEM 130)</b> ...focuses on how cells, organs, and organisms work. (174 covers the same material as 172 but is geared toward students who prefer a more problem-solving approach to understand biology, rather than a more traditional lecture-based course.)
<u><b>BIOLOGY 173</b></u> <b>(prerequisite = BIOLOGY 171, 172, 174, or 195)</b> ...is the accompanying lab component to the introductory sequence. The course provides an integrated introduction to experimental biology. Topics focus on biochemistry, molecular genetics, evolution, and ecology.	

### How do I get involved in research?

Independent research is a wonderful opportunity to take an active role in studying what you enjoy! Students participate in a lab, field, or modeling project in which they themselves have a say in the design, implementation, and interpretation of experiments. Please visit the Undergraduate Research web pages for the specific requirements for independent research and advice on how to choose a research area and mentor: <http://www.lsa.umich.edu/biology/studentresearch>.

### **What are the requirements for Honors?**

The Program in Biology administers an Honors Program to train students to conduct independent research in the biological sciences. Participating in the honors program allows students to develop their research skills, deepen their understanding of the field, and form productive relationships with faculty and other students. The achievement is noted on the diploma and official transcript.

In addition to completing all the requirements for the major, an honors degree requires:

- (1) a major GPA of at least 3.4, and
- (2) the completion of a significant piece of independent research that is
- (3) reported in an honors thesis and
- (4) presented in a public forum.

For more information, consult the Program in [Biology Honors Program information page](#) or a Program in Biology advisor.

### **How do I find out about internships, study abroad, or summer programs?**

Information about study abroad, faculty-led intercultural internships, faculty-led courses and field experiences, and Spring/Summer language study is available through the Center for Global and Intercultural Study. Please refer to [www.lsa.umich.edu/cgis](http://www.lsa.umich.edu/cgis) for detailed information about options.

### **Can I transfer courses from another institution?**

The Program in Biology will review classes taken at other institutions to determine equivalency to University of Michigan Biology, EEB, and MCDB courses. If an external class is determined to be equivalent to a U-M course, it can be posted to your transcript as the U-M Biology, EEB, or MCDB course (with a "T") when you successfully complete the course *and* the transfer steps listed on the Biology website: [www.lsa.umich.edu/biology/transferecredit](http://www.lsa.umich.edu/biology/transferecredit). Approved equivalent courses may count toward major requirements, but transfer students are encouraged to meet with a major advisor to develop a major plan.

[Note: You are welcome to request review of a course *before you take it*. You will need to provide a detailed syllabus, and must obtain one from the instructor in advance.]

### **How can I get involved with student organizations?**

There are several student organizations pertinent to biology-related majors. More detailed information is available on the Program in Biology website: [www.lsa.umich.edu/biology](http://www.lsa.umich.edu/biology).

- **Biology Student Alliance (BSA):** intended for Biology, CMB, Microbiology, Plant Biology, Neuroscience, and Biochemistry majors, as well as pre-med or science oriented students interested in learning more about MCDB-related topics. Email [BSA-Board@umich.edu](mailto:BSA-Board@umich.edu) for more information.
- **Botany Undergrads Doing Stuff (BUDS):** an extremely informal group of people dedicated to botany. Contact Faculty Advisors Robyn Burnham or Laura Olsen if interested.
- **Neuroscience Students Association (NSA):** an organization for students with an interest in neuroscience. Email [nsaleadteam@umich.edu](mailto:nsaleadteam@umich.edu) for more information.
- **Society of Biology Students (SBS):** an informal group for students interested in Biology in general. Website: <http://www.sitemaker.umich.edu/sbs/home> or contact the Faculty Advisor, Robyn Burnham at [rburnam@umich.edu](mailto:rburnam@umich.edu) for information.
- **Student Society for Stem Cell Research (SSSCR), University of Michigan – Ann Arbor Chapter:** an international network dedicated to the advancement of scientific research for cures. Website: [www.umich.edu/~umssscr/index.html](http://www.umich.edu/~umssscr/index.html). Email [ssscrexec@umich.edu](mailto:ssscrexec@umich.edu).

## UPPER-LEVEL ELECTIVE REQUIREMENT FOR MICROBIOLOGY

- 19 credits of Upper-Level Electives are required.
- A minimum of 11 credits must be selected from Groups 1 and 2, and must include:
  - at least two courses from Group 1, and
  - at least one course from Group 2.
- The remaining 8 credits may be selected from Groups 1, 2, or 3.

### **GROUPS 1 AND 2: SPECIFIED ELECTIVES** (A minimum of 11 credits is required.):

#### 1: Microbial Genetics, Physiology, Cellular Biology, Diversity, and Ecology—Select at least two courses.

EEB 315 Ecology and Evolution of Infectious Diseases (3)  
EEB 401 Advanced Topics (only sections applicable to Microbiology)  
EEB 446 Microbial Ecology (3)  
EEB 468 Biology of Fungi (4)  
EEB 470 Microbial Diversity (3)  
MCDB 401 Advanced Topics (only sections applicable to Microbiology)  
MCDB 408 Genomic Biology (3)  
MCDB 415 Microbial Genetics (3)  
MCDB 444 Bacterial Cell Biology (3)  
MCDB 489 Genes and Genomes (3)  
MICRBIOL 320 / INTMED 320 Bacterial Growth and Function (4) (also fulfills ULWR if taken Fall 2015 or later)  
MICRBIOL 430 Microbial Symbiosis  
MICRBIOL 460 / INTMED 460 Eukaryotic Microbiology (3)

#### 2: Microbial Pathogenesis, General Virology, and Immunology—Select at least one course.

EPID 460 Introduction to Bacterial Pathogenesis (3)  
MICRBIOL 405 Introduction to Infectious Disease (3)  
MICRBIOL 415 Virology (3)  
MCDB 436 or MICRBIOL 440 Immunology (3) (only one of these will count toward the major)

### **GROUP 3: ADDITIONAL ELECTIVES** (A maximum of 8 credits may be selected.):

#### Advanced Biochemistry, Molecular Biology, Cellular Biology

MCDB 411 or CHEM 452 Advanced Biochemistry (3-4)  
MCDB 416 Introduction to Bioinformatics (4)  
MCDB 427 Molecular Biology (4)  
MCDB 428 Cellular Biology (4)

#### Advanced Mathematics

Any MATH course with a MATH 116 prerequisite

#### Earth

EARTH 413 Geomicrobiology

#### Ecology

EEB 390, 391, or 392 Evolution (3-5)  
EEB 416 Introduction to Bioinformatics (4)  
EEB 476 Ecosystem Ecology (3)  
EEB 482 or 483 Freshwater Ecology (4-5)

#### Research

- Students are encouraged to participate in independent research with an appropriate faculty member. To use this option, two terms of independent research are required; however, **ONLY the 2<sup>nd</sup> term will count toward the major.**
- Students may select from: EPID 299 and EPID 399; MICRBIOL 299 and 399; two terms of INTMED 499; EEB 300 and 400; or MCDB 300 and 400. See your advisor to discuss the best course sequence option.
- Each course must be taken for a **minimum of 2 credits** each time. (3 credit max. applies; see CONSTRAINTS below.)

#### Epidemiology

EPID 504 Polymicrobial Communities Laboratory (3)  
EPID 505 Polymicrobial Communities in Human Health and Disease (3)  
EPID 507 Microbial Control: Sterilization, Disinfection and Manipulation (3)  
EPID 525 Clinical and Diagnostic Microbiology (3)

#### Microbiology And Immunobiology

Any MICRBIOL course at the 500-level or higher (with approval of an advisor)

#### Statistics

Any STATS course at the 400-level or above

# MICROBIOLOGY MAJOR REQUIREMENTS

## MICROBIOLOGY PREREQUISITES:

### Introductory Biology Sequence:

	TERM:	COURSE:	GRADE:
<input type="checkbox"/> Choose Sequence A or B:			
A: BIO 171, 172 or 174, & 173			
B: BIO 195 (AP) & 173			

### Chemistry Sequence:

<input type="checkbox"/> CHEM 210 & 211			
<input type="checkbox"/> CHEM 215 & 216			

### Quantitative Analysis Sequence:

<input type="checkbox"/> CALCULUS I: MATH 115, 120 (AP), 175, 185, or 295			
<input type="checkbox"/> One course from: MATH 116, 121 (AP), 156, 176, 186, or 296; STATS 180 (AP), 250 or 280; STATS 400-level or above (min. 3 credits); BIOLOGY 202; BIOPHYS/PHYSICS 290; EECS 203 or 280; EARTH 468; or other course with a MATH 115 prereq. approved by a major advisor [Note: Any course used to fulfill this requirement cannot also be used as a major elective; i.e., a course cannot "double-count."]			

### Physics Sequence:

<input type="checkbox"/> PHYSICS I (lecture + lab): One of the following combinations: PHYSICS 125 & 127; 135 & 136; 140 & 141; or 160 & 161. [PHYSICS 139 (AP) will also fulfill this requirement.]			
<input type="checkbox"/> PHYSICS II (lecture + lab): One of the following combinations: PHYSICS 126 & 128; 235 & 236; 240 & 241; or 260 & 261. [PHYSICS 239 (AP) will also fulfill this requirement.]			

## MICROBIOLOGY MAJOR:

### Core Courses

<input type="checkbox"/> Microbiology: BIO 207			
<input type="checkbox"/> Genetics: BIO 305			
<input type="checkbox"/> Biochemistry: Choose from: MCDB 310, BIOLCHEM 415, or CHEM 351			
<input type="checkbox"/> Advanced Laboratory: MCDB 306 or 429, or BIOLCHEM 416			

### Upper-Level Elective Requirement (A minimum of 19 credits is required.):

#### Specified Electives (A minimum of 11 credits is required.):

<input type="checkbox"/> Group 1 – choose at least two courses from Group 1 (Microbial Genetics, Physiology, Cellular Biology, Diversity, and Ecology) – see attached list.			
<input type="checkbox"/> Group 2 – choose at least one course from Group 2 (Microbial Pathogenesis, General Virology, and Immunology) – see attached list.			

#### Additional Electives:

<input type="checkbox"/> Group 3 – choose from Groups 1, 2, or 3 – see attached list.			
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### CONSTRAINTS:

<ul style="list-style-type: none"> <li>Prerequisites, introductory science courses, and non-specific (departmental) transfer courses are EXCLUDED from the 32 cr. required for the major.</li> <li>A maximum of three credits of independent research (EEB 400, MCDB 400, EPID 399, INTMED 499, or MICRBIOL 399) may count toward the major.</li> <li>Only one of MCDB 436 and MICRBIOL 440 will count toward the major.</li> </ul>			
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### Total Credits and GPA Requirement for Microbiology:

<input type="checkbox"/> Minimum 32 cr. in Major			
<input type="checkbox"/> Minimum 2.0 GPA in Major GPA is calculated from all mandatory prerequisites, all courses used for major requirements (including cognates), and all courses in BIOLOGY, EEB, MCDB, EPID, INTMED, and MICRBIOL.			